ACTA
ORTHOPAEDICA
et
TRAUMATOLOGICA
TURCICA

Acta Orthop Traumatol Turc 2011;45(4):288-290
doi:10.3944/AOTT.2011.288

Response to: Evaluation of the medial longitudinal arch: a comparison between the dynamic plantar pressure measurement system and radiographic analysis

Dear Editor,

We have read the article "*Evaluation of the medial longitudinal arch: a comparison between the dynamic plantar pressure measurement system and radiographic analysis*" by Yalçın et al.[1] with interest. We want to congratulate the researches. However, we would like to share some questions related to this study with you.

The medial longitudinal arch varies with age as the authors indicated. Although the wide sampling age range (11-85 years) compatible with the universe of patients encountered in the daily practice is an advantage, this can be cause problems in "definition" and "interpretation" of an age-related parameter and affect the error rate of inferences. In this context, having similar number of patients in predefined age ranges and making statistical evaluation accordingly will minimize error when interpreting the results. We consider that such a sub-assessment analysis would be appropriate. Additionally, indicating standard deviation in this parameter with wide range could also give an opinion to us.

In the study, 95 patients who were found to have normal feet based on radiographic examination were included in the study. Because results of radiological assessment have quite a wide range, we think that evaluation criteria for a "normal" foot should be clearly stated. Additionally, because roentgenograms of both right and left feet of the subjects were taken and the sample size was doubled (95x2), the effect of dominant foot on pressure values should also be investigated. Body weight or body-mass index is one of the other factors that may affect the pressure, so we think that also an evaluation could be done from this aspect.

Our other concerns related to the methodology of the study is about how long the walking time is, when the values are taken as a measurement and if the current software program is ever used to evaluate or not in a research like this or another similar topic. We believe that informing on these issues would be useful.

Studies have shown that assessments and measurements related to foot can change with loading and severity of loading and this variation is especially prominent in patients with foot problem.[2,3] In this context, measurement of some feet which are normal under static conditions may reveal pathological values under certain load. In the study, presence of patients with radiologically normal but pathologic in pedobarometric measurements may cause problems in comparison. From this perspective, normal pressure values in normal cases should be clearly stated and the measurements obtained should be classified accordingly. When the values obtained from the study from 0.04 to 0.17 has been accepted as a reference value for normal subjects, the authors' opinions on the reasons of this wide range will enlighten us.

In the last paragraph the statements "*the talo-first metatarsal and talohorizontal angles also give helpful information on the height of the arch where a pedobarograph is not available. The talo-first metatarsal and talohorizontal angles obtained statically may predict dynamic posture of the foot.*"[1] are taken part. Midfoot pressure measurement is written in the numerator part of the formula that is used as an arch index. However, calcaneal pitch angle and talocalcaneal angle are used in the evaluation of the back foot as specified by the authors. We believe that it should be made clear whether or not there is a relationship between back foot pressure values or index measurements which take it as a reference and static angular measurements evaluating the back foot should. Any conclusion derived from these data should be presented in detail. In addition, statistically insignificant inverse relationship (r; negative) between talocalcaneal and calcaneal pitch angles and arch index was found in the evaluation of the correlation. In other words, these two angles will decrease as index increases and vice versa. In this context, making inferences without considering the relationship between the measured angles themselves can lead to possible errors. We think that when the relationship between

talohorizontal, talo-first metatarsal angles in significant correlation and talocalcaneal, calcaneal pitch angles in insignificant inverse correlation with arch index are assessed, comments and inferences may also be different according to the obtaining significant or insignificant results in pressure measurements.

Best regards,

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Authors' reply

Dear Editor,

We would like to thank you having allowed us to answer this letter. We are glad that our article has created interest and has afforded the expressed thoughts on the authors of the letter.

This study was planned that there is lack of comparison studies with wide range of age in adult population although there are some in pediatric age groups. As we know, arch shows variability in accordance with bone development. After bone maturation, it becomes constant in adulthood unless there occurs a secondary pathology. Thus, we did not subgroup the normal individuals according to age, thinking that would not change our results significantly. Also the main purpose of this study was to compare dynamic foot pressure parameters and static radiographic parameters. The correlation of these two is not dependent with age. According to us, for this reason, evaluating the age with subgroups is not pertinent.

The individuals enrolled to the study were the ones applied to the pedobarography laboratory for different reasons and neither any pathology nor deformity detected after both clinical and radiological examinations. In addition, no mechanical disorders established after pedobarographic analysis. In other words, normal concept is defined as the feet without any deformity detected clinically and without any radiological deformity on tarsal, metatarsal bones and phalanxes altering the anatomical structure of the foot.

Because the comparison of the data of right and left foot is not different between each other, only the data of one side was used in the whole study in order to prevent statistical confusion.

It is known that weight and body mass index have influence on foot pressures. However, in this study, arch index was calculated as the proportion of the area of middle foot to the sum of the areas of the whole foot (forefoot, midfoot, hindfoot, except phalanxes) during stance phase, not with the plantar pressures of the foot. Therefore, pressure values are out of scope of this study.

Pedobarographic data obtained from the study group was compared with the radiographic data obtained during the same time. During evaluation, the standardized tecnique of our laboratory was used. For standardization, all subjects walked on the walking platform, having at least three steps for each foot before stepping on the middle of a 7m platform. The pressure pictures were saved only if the whole foot reflects on the platform, letting for the analysis. It would be better that we have mentioned this point in detail in the article. We would like to thank for the suggestion of the authors. For evaluation, the original

softwares mentioned in the article were used. The same softwares and the technique have been also used in similar studies.[1,2]

The defined normal values of arch index can also be seen in wide range in the literature.[2,3] The reason might be the variability of normal foot anatomy in person to person and reflection of this variability to the results of pedobarographic analysis, same as the measurement of radiographic analysis of angles accordingly.

Evaluating the arch index values of normal or pathological feet was not the scope of this study. To accentuate, area analysis, not pressures, were evaluated in this study. The individuals having severe structural abnormalities were not enrolled to the study. In addition, individuals only expressing difference on arch height were not removed. As in the article that the authors cited, there are some studies showing foot plantar pressure changes in pathological subjects. However, there are other studies arguing just the opposite.[4] Today, it is clear that plantar pressures may be effected by variations and pathologies of a kinematic chain starting from the back to the toes. Because radiographic values and plantar areas were used as they are indicators of medial arch height, the study was independent with pressure values.

The four radiographic measurement method used and referred in the article are believed as they are giving information on medial longitudinal arch of foot and are being used rather frequently in general. In addition, the arch index used in the study is a method that informs about the medial longitudinal arch of foot which can be determined both statically and dynamically. The reason of writing the middlefoot area to the numerator of the fraction is because of any increase and decrease of this area will inform us about the degree of medial arch height. In case of a decrease in arch (pes planus), medial area increases and thus, index value increases. In pes cavus, it is just the opposite.

The negative values of talocalcaneal and calcaneal pitch angles might be confusing whether if there found a statistical difference with arch index. Increasing of calcaneal slope which is a parameter of both measurements, increases the height of arch. Because an increase in arch height means a decrease in arch index, negative correlation would be expected. As mentioned in the article, these two angles were not found to be correlated significantly with arch index ($p>0.05$).

Sincerely,

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